

REMARKS

Reconsideration and allowance of this application, as amended, is respectfully requested.

This Amendment is in response to the Office Action dated April 5, 2005. By the present Amendment, the rejected claims 1-8 have been canceled and replaced with new claims 20-26 for clarification. In particular, the new claims 20-26 are directed to the elected invention, but serve to clarify the distinctions of the invention over the cited prior art.

Reconsideration and removal of the rejections made against the original claims 1-8 based on the references to Abe (U.S. Patent No. 6,410,979), Minamio (U.S. Patent No. 6,642,609) and Johnson (U.S. Patent No. 5,726,079) is respectfully requested. New independent claim 20 specifically defines the structure of the plural leads to include first leads and second leads (disposed between adjacent ones of the first leads). Each of the first and second leads, respectively, includes first terminal portions and second terminal portions. In conjunction with this, claim 1 specifically defines:

“wherein end portions on one side of each of the plural first leads are positioned outside said semiconductor chip;
wherein end portions on one side of each of the plural second leads are fixed to a back surface of said semiconductor chip;
wherein the first terminal portions are arranged along side faces of the resin sealing member respectively; and
wherein the second terminal portions are arranged inside said first terminal portions respectively.”

It is respectfully submitted that this recited arrangement of the end portions of the plural first leads being positioned outside the semiconductor chip while the end portions of the second leads are fixed to the back surface of the semiconductor chip, in conjunction with the arrangement of the first and terminal portions, is completely

lacking from the primary reference to Abe as well as the secondary references to Minamio and Johnson. In particular, the claimed arrangement for the end portions of the first and second leads and the first and second terminal portions provides an arrangement which specifically suppresses the deterioration of adhesion for the second leads which are more susceptible to such deterioration. Ideally, it would be preferable to fix all leads to the back surface of a semiconductor chip (such as that identified by the numeral 2 in Fig. 3). Unfortunately, because the number of leads is typically quite large, it is impractical in most instances to do this. On the other hand, certain leads are more susceptible to deterioration in their adhesion due to a lowering of the urging force which is placed on them. Accordingly, the above-noted features for locating the end portions of the first and second leads and the first and second terminal portions serves to provide firm adhesion for the second leads on the back surface of the semiconductor chip to avoid the deterioration in adhesion which they are more susceptible to.

More specifically, referring to Figs. 3-7 of the specification, for example, positioning of the lead frame LF is performed in a state in which the opposite end portions of the leads (second leads 5a, first leads 5b) are vertically sandwiched between the mating surfaces of the upper and lower die halves 25a, 25b and the terminal portions 6 (second terminal portion 6a, first terminal portion 6b) of the leads 5 (5a, 5b) are in contact with the inner surface of each cavity 26. By virtue of this, with the resilience of the metallic sheet which constitutes the lead frame LF, a force is created so that the terminal portions 6 of the leads 5 are urged towards the inner surface of the cavity 26. As a result, the terminal portions 6 of the leads 5 come into close contact with the inner surface of the cavity 26. However, this urging force becomes weaker as the distance from clamp portions (i.e., peripheral edges of each

of the cavities 26) of the molding die 25 which holds the opposite ends of the leads 5 grippingly becomes longer. Therefore, the second terminal portions 6a spaced a larger distance from the clamp portions 6b receive a weaker urging force against the inner surface of each cavity 26. That is, the second terminal portions 6a are more likely to suffer from deterioration in their adhesion to the cavity 26 than the first terminal portions 6b are. Therefore, the inconvenience of the second terminal portions 6a being covered with resin flash becomes likely to occur.

On the other hand, in the present claimed invention, end portions on one side of the plural second leads 5a are bonded and fixed to the back surface 2y of the semiconductor chip 2. According to this construction, it is possible to suppress lowering of the urging force of the second terminal portions 6a acting on the inner surface of the cavity 26. Consequently, it is possible to suppress deterioration of the adhesion between the inner surface of the cavity 26 and the second terminal portions 6a of the plural second leads 5a. Thus, it is possible to suppress the occurrence of the inconvenience that the second terminal portions 6a of the plural second leads 5a serving as back electrodes (external terminals) of the resin sealing member 8 are covered with resin flash.

Of course, as noted above, it is preferable to fix all the leads to the back surface of the semiconductor chip 2. However, in the case where the number of leads is large, it is difficult to fix all the leads to the back surface 2y of the semiconductor chip 2. This is because it is necessary that the layout pitch at end portions on one side of the leads are made narrower than that at the opposite ends of the leads and because a limit is encountered in machining the leads. Accordingly, where the number of leads is large, it is preferable that the plural second leads 5a having the second terminal portions 6a, which are worst in terms of resin flash

occurrence, are selected and fixed to the back surface of the semiconductor chip 2, as defined in new claim 20.

The primary reference of Abe does not show the structure, as defined in the new independent claim 20. More specifically, the technique of Abe is that a semiconductor device 1 has a semiconductor element 14 sealed with a resin material 18. In addition, a lead frame 10 is connected to the semiconductor element 14 in the resin material 18. The lead frame 10 is provided with terminal portions 10a that protrude through the surface of the resin material 18. Accordingly, this facilitates cleaning flux residues remaining in between the package and the substrate, and this provides reduced material and manufacturing costs.

Although these teachings in Abe may be of a general interest, Abe does not teach that a part of the lead frame 10 which are worst in terms of resin flash occurrence are selected and fixed to the back surface of the semiconductor element 14. Instead, Abe discloses that all of the lead frames 10 are fixed to the back surface of the semiconductor element 14. Since it is difficult to fix all of the lead frame 10 to the back surface of the semiconductor 14 because it is necessary that the layout pitch at end portions on one side of the leads are made narrower than that at the opposite ends of the leads and because a limit is encountered in machining the leads, the Abe system is much less practical than the arrangement defined by new claim 20.

Similarly, the reference of Minamio et al., does not show the structure as defined in the new claim 20. As recognized by the Examiner, the technique of Minamio et al. is an arrangement of external terminals that are closer to the sealing member and external terminals 16 that are arranged away from the face of the resin sealing 15 and each disposed between adjacent ones of the first terminal portions.

However, Minamio also does not teach that the plural second leads which are worst in terms of resin flash occurrence are selected and fixed to the back surface of the semiconductor chip. And, Minamio does not suggest the problem that it is difficult to fix all the leads to the back surface of the semiconductor chip.

As a result, as noted above, it is respectfully submitted that new independent claim 20 and its dependent claims 21-26 clearly define over the cited prior art, and reconsideration and allowance of these claims is respectfully requested.

If the Examiner believes that there are any matters which can be resolved by way of either a personal or telephone interview, the Examiner is invited to contact Applicants' undersigned attorney at the number indicated below.

Applicants request any shortage or excess in fees in connection with the filing of this paper, including extension of time fees, and for which no other form of payment is offered, be charged or credited to Deposit Account No. 01-2135 (Case: 501.43736X00).

Respectfully submitted,
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September 6, 2005